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Do You See What I See? The Impact of Age Differences in Time Perspective on Visual Attention

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In young adults, having a relatively long time perspective has been associated with a more abstract, holistic approach to cognitive tasks, as opposed to the more concrete, detailed approach associated with having a more limited or near-future focus (Trope & Liberman, 2003). Here we studied the impact of age differences in temporal perspective on performance on a classic visual attention task (Navon, 1977) that allowed for an orientation toward either detailed or holistic processing. Consistent with views on temporal perspective and cognition (Liberman, Sagristano, & Trope, 2002), we found that younger adults were more likely than older adults to orient toward holistic processing.

ALTHOUGH aging affects fundamental cognitive processes, it may also impact how people approach cognitive tasks. For example, there is evidence that younger and older adults differ in goals, in social contexts, in circadian arousal patterns, and in cultural stereotypes. These differences are associated with age-related changes in performance on cognitive tasks (see Hasher, Goldstein, & May, 2005; Hess, 2005). Younger and older adults may also approach cognitive tasks differently because they differ in their temporal perspective, or the extent to which they view the future as limited or open ended, with older adults perceiving time as more limited than do younger adults (Fung, Lai, & Ng, 2001; Lang & Carstensen, 2002). This is important because there is evidence suggesting that differences in orientation toward future time among young adults can influence the approach individuals take on cognitive tasks involving creativity and insight (Förster, Friedman, & Liberman, 2004), decision making (Malkoc, Zauberman, & Ulu, 2005), and categorization (Liberman, Sagristano, & Trope, 2002).

The temporal perspective and cognition work has been done within the framework of the construal level theory (Liberman & Trope, 1998; Trope & Liberman, 2003), which proposes that temporally distant events are represented at an abstract level while temporally proximate events are represented at a more detailed, concrete level. In turn, level of representation is thought to guide cognition. For example, in a series of studies, Förster and colleagues (2004) primed a particular temporal framework by asking participants to think about performing a task either "tomorrow" (near-future condition) or "one year from now" (distant-future condition). Participants in the distant-future condition showed better performance on verbal and visual insight problems and generated more creative solutions than did participants in the near-future condition. In contrast, participants in the near-future condition showed better performance on tasks that required analytic problem solving than did participants in the distant-future condition.

Existing research on temporal construal has used young adult participants and manipulated temporal perspective by using priming techniques. It has not, to our knowledge, considered the impact of group differences in future time perspective. Given evidence that older adults tend to conceive of their futures as limited (Fung et al., 2001; Lang & Carstensen, 2002), it is plausible to assume that, as a group, they generally have more near-future-focused time perspectives than do younger adults. In this way, age differences in time perspective may influence how younger and older adults approach some cognitive tasks, with older adults more likely to focus on low-level representations and details and with younger adults more likely to focus on holistic representations.

In the present study we explored age differences in future time perspective and their impact on visual attention by using hybrid stimuli that enabled a measure of attention to low-level details versus high-level, global features of a stimulus. We did this by using Navon's (1977) global–local paradigm (see also Kimchi, 1992). The stimuli were composed of large letters or shapes (global configuration) that were made of smaller letters or shapes (local configuration; e.g., a large H made of smaller Ss; see Figure 1). We presented these stimuli with instructions for the participant to respond to either the local or the global level. Under global instructions, the correct response to a large H made of smaller Ss was "H," whereas the correct response to the same stimulus was "S" under local instructions. We compared the performance on trials with interfering local and global elements with the performance on large or small stimuli that were not subject to interference.

On the basis of construal level theory (Liberman & Trope, 1998; Trope & Liberman, 2003), we expected that the distant-future time perspective would be associated with faster responding to global features than local features (the "global precedence" effect) as well as increased interference from an incongruent global letter during the local part of the task (the "global interference" effect; Kimchi, 1992). Therefore, we expected young adults, with their generally distant-future focus, to be more likely than older adults to show global precedence and global interference effects.

We also considered the possibility that we could shift the baseline, age-related temporal frameworks of our participants

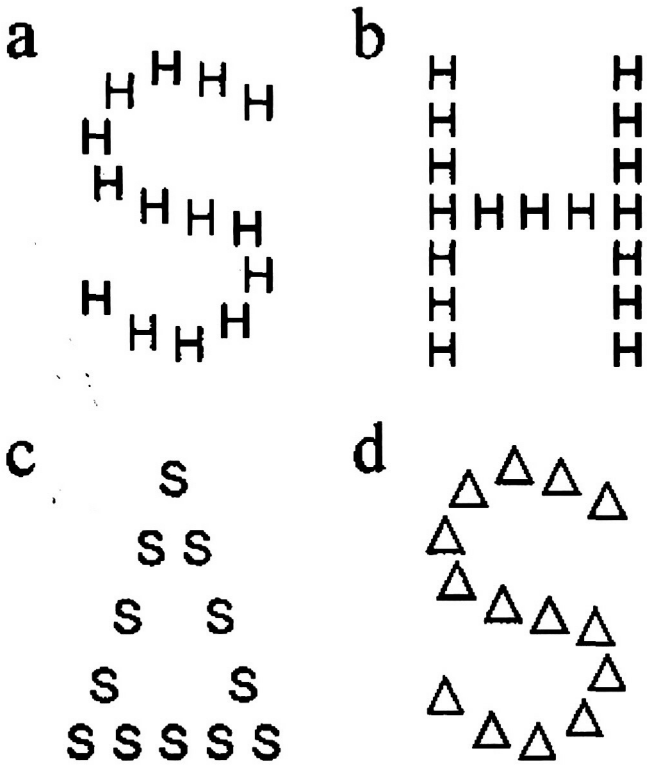

Figure 1. Examples of stimuli used in the global–local task. Inconsistent stimuli were those in which the global letter was different from its local component letters. (a) Consistent stimuli were those in which the same letter appeared at both the global and local level. (b) Neutral stimuli are those in which global and local level target shapes differ. (c) In the local condition, small letters form a large geometric shape. (d) In the global condition, small shapes form a large letter.

by randomly assigning groups of younger and older adults to near-future versus distant-future time perspective conditions. To manipulate participants' temporal frameworks, we asked participants to think of performing a task either tomorrow or 1 year from now to prime near- and distant-future time perspectives (Förster et al., 2004) just prior to the participants' completion of the local–global classification task. Participants in the distant-future condition were expected to differentially focus on high-level relative to low-level features of stimuli, resulting in a greater global precedence effect and more interference from global features of the stimuli, than participants in the near-future condition from the same age group.

Methods

Participants

Sixty-eight younger adults (17–25 years) and 68 older adults (60–75 years) participated in this study. Younger adults were undergraduate students and received course credit for their participation. Older adults were recruited from a seniors' participant pool and received monetary compensation. Younger adults ($M = 19.07$, $SD = 2.72$) had an average of 12.62 ($SD = 1.51$) years of education, and a mean score of 30.25 ($SD = 2.78$) on the Shipley Vocabulary Test. Older adults ($M = 68.62$, $SD = 4.15$) had significantly more years of education ($M = 16.38$, $SD = 3.97$), $F(1, 135) = 53.20$, $MSE = 8.91$, $p < .05$, and a significantly higher score on the Shipley Vocabulary Test ($M = 36.49$, $SD = 2.87$), $F(1, 135) = 165.59$, $MSE = 7.98$, $p < .05$. We replaced data from 1 younger participant and 4 older participants because either they did not follow task instructions (3 older adults) or they had low accuracy on the global–local task (incorrect responses on more than one third of the trials; 1 younger and 1 older adult). There was also 1 older participant whose reaction times were greater than 4 *SD* from all other older adults; we excluded this participant's data from all analyses, resulting in a final sample of 67 older adults and 68 younger adults.

Materials

Global–local task.—We had a series of stimuli consisting of smaller letters or geometric shapes (local level) making up larger letters or geometric shapes (global level) presented on a computer screen (letters at the global and local levels were either Hs or Ss and shapes were either rectangles or triangles). There were three types of stimuli presented to participants: consistent, inconsistent, and neutral (see Figure 1 for examples of the stimuli and a complete description).

Future time perspective measure.—The Future Time Perspective (FTP) Scale (Lang & Carstensen, 2002) consists of 10 items that measure perception of future time (e.g., "Many opportunities await me in the future" and "There is plenty of time left in my life to make new plans"). Agreement is rated on a 7-point scale anchored from very untrue to very true. We created a total score by adding up the ratings on all items focusing on an expansive future and the reverse scores of items focusing on a more limited future. Higher scores indicate perception of the future as more expansive relative to lower scores.

Mood measure.—The Brief Mood Introspection Scale (BMIS; Mayer & Gaschke, 1988) consists of 16 adjectives that are rated on a 7-point scale anchored from definitely do not feel to definitely feel. Instructions specify that ratings should be made based on one's *present mood*. We totalled ratings for adjectives associated with positive emotions along with reverse-scored ratings from adjectives associated with negative emotions to form a composite mood rating. The scale also includes an overall mood rating based on a single question with a 20-point scale anchored from −10 (very unpleasant) to 10 (very pleasant).

Design and Procedure

In this study we used a 2 (Age: young, old) × 2 (Temporal Condition: near future, distant future) × 2 (Processing Level: global, local) × 3 (Stimulus Type: inconsistent, neutral, consistent) factorial design with age and temporal condition as between-participants factors and processing level and stimulus type as within-participant factors.

We tested all participants individually at the relative optimal time of day for their age group (i.e., younger adults in the afternoon and older adults in the morning; Hasher, Goldstein, & May, 2005). At the beginning of the study, participants spent

3 minutes imagining that they were engaging in everyday activities either tomorrow (near-future condition) or 1 year from now (distant-future condition). The experimenter left the room to avoid distracting the participants, and returned after 3 minutes. Next, participants completed the computerized global–local task, consisting of 12 practice trials followed by four blocks of 48 trials each. At the beginning of each experimental block, the experimenter instructed the participants to either respond to the large letter (i.e., global instructions) or the small letter (i.e., local instructions). We counterbalanced the order of local and global blocks across participants. In each block, half of the trials involved neutral stimuli and the other half was divided equally between consistent and inconsistent trials. Each trial began with a fixation cross presented in the center of the screen for 1,000 ms, which was immediately followed by the presentation of the stimulus, which remained on the screen until the participants entered their response by pressing the designated key on the keyboard.

Participants then completed the FTP Scale and the BMIS. They were asked to write down what they were thinking about while engaging in the imagination task at the beginning of the study in order to ensure that they followed instructions (i.e., to think about doing activities in the appropriate time frame). Participants then completed a background questionnaire followed by the Shipley Vocabulary Test (Shipley, 1946) and Short Blessed Test (older adults only; Katzman et al., 1983). Finally, participants were debriefed and compensated or given experimental credit for their participation.

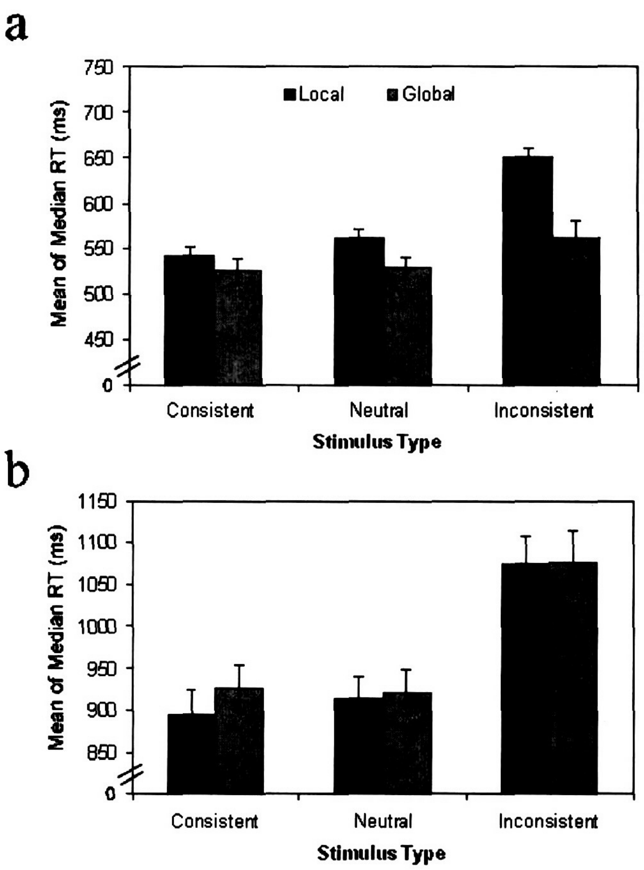

Figure 2. Mean of median reaction time (RT) on the global–local task for (a) younger and (b) older adults as a function of processing level and stimulus type. Error bars indicate ± 1 *SE*. The global precedence effect involves slower responding on local neutral compared with global neutral trials. The global interference effect involves comparing the difference in RTs between local neutral and local inconsistent trials. The local interference effect involves comparing the difference in RTs between global neutral and global inconsistent trials.

Results

We used an alpha level of $\alpha = 0.05$ for all statistical tests, unless otherwise noted.

Future Time Perspective

We conducted a 2 (Age Group: younger, older) × 2 (Temporal Condition: near future, distant future) analysis of variance on these scores. The only reliable effect was for age, such that younger adults (M = 52.46, SD = 8.54) reported a more expansive future time perspective than did older adults (M = 41.09, SD = 11.42), $F(1, 131) = 48.17$, $MSE = 97.52$, $p < .05$; all other Fs < 1. Thus instructions intended to manipulate temporal construal did not produce differences in self-reported future time perspective for participants in either age group, despite postexperimental reports suggesting that both young and older adults complied with temporal construal instructions.

Performance on the Global–Local Task

We analyzed median reaction times (RTs) for correct responses after we deleted error trials (the pattern of findings reported here was the same when means and trimmed means were each used as the dependent measure). The mean error rates were 2.9% for young adults and 2.0% for older adults. We excluded RTs faster than 250 ms or slower than 4,000 ms (approximately 0.8% of all trials) from our analyses. Figure 2 displays median RTs.

Global precedence effect.—The global precedence effect (Navon, 1977; Yovel, Revelle, & Mineka, 2005), based on evidence from young adults, is faster responding to the global feature of a stimulus than the local feature of a stimulus when interfering information is absent. We conducted a 2 (Age Group: younger, older) × 2 (Processing Level: global, local) analysis of variance on the median RTs on neutral trials (i.e., RT to Figure 1d vs RT to Figure 1c). As is typical, younger adults responded faster overall than did older adults, $F(1, 131) = 210.75$, $MSE = 43{,}088.56$, $p < .05$. Although the main effect of processing level was not significant, $F < 1$, there was a significant Age Group × Processing Level interaction, $F(1, 131) = 10.95$, $MSE = 4{,}875.84$, $p < .05$. On the basis of previous evidence in the attention literature, as well as on their more expansive time perspective, we expected young adults to show a strong global precedence effect, and they did (global neutral vs local neutral), $t(67) = 5.53$, $p < .05$. In contrast, older adults did not show a global precedence effect, $t(66) = 0.82$, *ns*, consistent with the idea that a near-future focus is associated with greater attention to details than to global elements.

Global and local interference effects.—Previous research with young adults (Navon, 1977; Yovel et al., 2005) shows that large letters are more disruptive to the identification of small letters (the global interference effect;) than small letters are to the identification of large ones (local interference effects; e.g., saying "H" to Figure 1A is more difficult than "S" to the same figure, relative to their controls: 1c and 1d, respectively). As displayed in Figure 2, young adults showed this pattern by responding 88 ms slower when the large letter conflicted (local inconsistent vs local neutral), $t(67) = 19.53$, $p < .05$, and only 33 ms slower when the small letter conflicted with the correct response (global inconsistent vs global neutral), $t(67) = 3.32$, $p < .05$. Thus, younger adults showed greater global interference than local interference, $t(67) = 5.28$, $p < .01$, a pattern consistent with greater attentional preference for global elements for those with a distant-future time perspective.

Overall, older adults (M = 165.80, SD = 139.49) showed greater interference effects than did younger adults (M = 68.14, SD = 57.85), $F(1, 133) = 27.37$, MSE = 21,573.63, $p < .05$. However, older adults showed roughly equivalent levels of interference from both global (M = 156.76, SD = 133.51) and local (M = 152.13, SD = 196.46) features, $t(67) = 0.20$, *ns*. The observed age differences in interference effects also support the view that time perspective influences level of processing, such that younger adults with a more expansive time perspective are more likely to process the stimulus on a global level, even when optimal task performance requires ignoring the global level and focusing on the local level.

Time Perspective and Global–Local Performance

Although the instructional manipulation of temporal framework did not produce differences in scores on the FTP Scale, it is plausible that either the scale was not sensitive to differences in temporal construal or the effects of the manipulation dissipated before the participants completed the scale. Thus, we also investigated performance differences in the global–local task as a function of temporal condition. Neither the main effect of temporal condition was significant, $F < 1$, nor were the interactions with age and processing level, Fs < 1. Thus, the instructions intended to manipulate temporal construal did not result in differences in global precedence or interference at the global and local level.

We also explored the relationship between FTP scores and the three effects discussed herein, global precedence and global and local interference. Collapsed across young and older adults, all three correlations were near or at significance, rs = .15 (p = .08), –.20 ($p < .05$), and –.25 ($p < .05$), respectively. Thus, a more expansive view of the future was associated with greater global precedence and less interference at both the global and the local level. However, none of these correlations was significant after we controlled for the age of the participant, all ps $> .05$, thereby suggesting that age differences in time perspective drove the relationship between FTP scores and performance on the global–local task.

Self-Reported Mood

In replication of earlier findings (e.g., Carstensen, Pasupathi, Mayr, & Nesselroade, 2000; Charles, Reynolds, & Gatz, 2001; Gross et al., 1997; Mroczek & Kolarz, 1998; Thomas & Hasher, 2006), we found that older adults reported a more positive mood (M = 89.48, SD = 11.52) than did younger adults (M = 73.01, SD = 12.31) on the composite measure, $t(133) = 8.02$, $p < .05$, as well as the overall mood rating, $t(133) = 4.82$, $p < .05$. More positive mood was associated with more expansive FTP within young adults, $r(68) = 0.47$, $p < .05$, and older adults, $r(67) = 0.47$, $p < .05$. Given the significant relationship between FTP and self-reported mood, we repeated the analyses on the global precedence effect and interference effects with self-reported mood included as a covariate. Mood was not a significant covariate and the basic pattern of findings remained stable with mood included in the analyses. Thus, age differences in mood did not account for the observed differences in performance on the local–global task.

Discussion

In the present study we investigated age patterns in future time perspective and their impact on visual attention. Although we attempted to manipulate participants' temporal frameworks by asking participants to imagine completing a task either tomorrow or 1 year from now, the manipulation did not result in differences in reported future time perspective or changes in performance on the visual attention tasks. However, there were overall age differences in baseline temporal frameworks such that older adults viewed the future as more limited than did younger adults, which is consistent with the work of Carstensen and her colleagues (e.g., Lang & Carstensen, 2002).

Based on performance on the global–local task, our predictions about age differences in visual attention were confirmed: Young adults responded faster to global features than to local features (i.e., global precedence effect) and experienced greater interference from global than local features. This pattern replicates well-established effects in the attention literature (Navon, 1977; Yovel et al., 2005). In contrast, older adults did not show a global precedence effect and they demonstrated similar levels of interference from global and local features. This pattern of findings is generally consistent with the predictions of the construal level theory (Liberman & Trope, 1998; Trope & Liberman, 2003), which posits that the orientation individuals have to the future influences their approach to at least some cognitive tasks. In particular, people with a more distant-future focus (here, younger adults) are oriented toward global features whereas those with a more near-future focus (here, older adults) attend more to details or local features.

Although the results are consistent with the predictions of the construal level theory (Liberman & Trope, 1998; Trope & Liberman, 2003) based on future temporal frameworks, age differences in regulatory focus offers an alternative account for the observed pattern of results. Förster and Higgins (2005) found that regulatory focus influenced level of attention in the global–local task, such that global processing was associated with a promotion focus on advancement whereas local processing was associated with a prevention focus on security. Indeed, previous work suggests that older adults have more of a prevention focus than do younger adults (Ebner, Freund, & Baltes, 2006; Lockwood, Chasteen, & Wong, 2005), which could also result in more local processing. Likewise, there is evidence that younger adults are more likely to take on a prevention focus in the presence of stereotype threat (Seibt & Förster, 2004), which older adults may be more likely to experience in the context of an experiment as the result of the presence of a young experimenter or any reminder of their age. If stereotype threat is also associated with prevention focus in older adults, age differences in regulatory focus could contribute to older adults' attention to more detailed elements. Thus, regulatory focus could be an additional factor that influences how older adults approach cognitive tasks, thereby resulting in age differences in cognitive performance that are independent of ability. A direct test of this alternative explanation for age differences in the level of attention awaits future research.

The present study was focused on young and older adults' orientation toward the future; however, construal level theory (Liberman & Trope, 1998; Trope & Liberman, 2003) also makes parallel predictions about orientation toward the past. Although older adults view the future as more limited than do younger adults (Lang & Carstensen, 2002), they may, under some circumstances, view the past as expansive and so focus more on the distant past than do younger adults. When this occurs, older adults may approach tasks with a bias toward global features. This remains to be tested empirically, but it is important to recognize that temporal construal and the scope of future time (as measured by the FTP Scale; Lang & Carstensen) are distinct constructs. Indeed, the direction of temporal orientation may well be another important mediator of age differences in cognitive performance and an interesting course for future research.

Furthermore, our finding that older adults rely less on global processing in visual attention than do younger adults is surprising given its contrast with other work demonstrating an age-related increase in reliance on gist or more global features in memory performance (e.g., Tun, Wingfield, Rosen, & Blanchard, 1998). Likewise, one might expect older adults to focus on larger elements in a visual display as a result of an age-related decline in visual acuity (West et al., 1997). Thus, age differences in temporal frameworks and regulatory focus may prove to be powerful influences on visual attention that counteract effects of poor vision and a tendency toward global processing in memory.

The present study provides additional evidence for an age-related decline in the ability to suppress irrelevant information (see Hasher, Zacks, & May, 1999, for a review). Much previous research has demonstrated that older adults are more distracted than younger adults by irrelevant information (e.g., Connelly, Hasher, & Zacks, 1991). Indeed, older adults showed greater interference from global and local elements compared with younger adults, thereby resulting in slower response times when the distracting information was inconsistent with the correct response.

The present study extends previous aging research by exploring a novel factor, temporal construal (or future time perspective), that may influence differences between young and older adults in their approach to cognitive tasks. Indeed, the present study joins previous research on contextual differences (Hess, 2005) between young and older adults that highlights the need to exercise caution when attributing age differences in cognitive performance to a decline in ability.

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